

The effect of replacing hydrogen by hydrocarbon radicals in rosaniline is seen to result in the shade of colour becoming blue for each hydrogen replaced—the effects of those of high molecular weight, such as phenyl, being to produce the bluest shades; thus triphenylrosaniline is blue, whilst hexamethylrosaniline is blue-violet, notwithstanding it contains six hydrogens replaced.

After all the replacements possible have been effected, as in hexamethylrosaniline, the result of the combination of the products with halogen compounds of methyl is very interesting. The particular group to which this is attached becomes of the nature of an ammonium, and the colour changes to green—i.e., methyl green—and this, like other ammonium compounds, when heated, dissociates, with loss of the halogen compound of methyl, and then hexamethylrosaniline is reproduced. Again, if this ammonium group be replaced by phenyl, we also get a green—i.e., Victoria green.

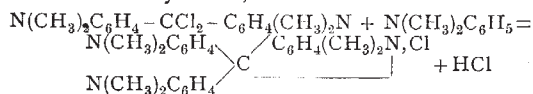
The structure of some of these bodies has been proved by another most beautiful synthetical process, which has lately come into use—a process which enables us now not only to say that we employ the volatile products of the distillation of coal, but also the coke itself; as carbonic oxide, in combination with chlorine, is one of the important agents—i.e., phosgene or carbonoxychloride is used. This product was discovered in 1812 by J. Davy.

In 1876 W. Michler gave an account of his researches on the synthesis of aromatic ketones by means of phosgene (*Ber.* ix. 716), in which he showed by the action of this substance on dimethylaniline that a tetramethylised diamidobenzophenone was contained. This substance has, therefore, the constitution—



The formation of this product takes place in two phases, but I need not enter into that now.

The first experiments to turn Michler's synthetically prepared tetramethylated diamidobenzophenone to practical account were made by Dr. A. Kern, in the works of Bindschedler, at Basle. Dr. Kern proved that an agent like phosgene might be produced on a larger scale, and he invented a process to convert Michler's ketone base into methyl purple. This process was derived from the ketone synthesis of triphenylmethane from benzhydrol and benzene, and consisted in preparing the tetramethyldiamidobenzhydrol, and condensing the latter with dimethylaniline; thus the leuco base of hexamethylrosaniline was obtained, and then oxidised with lead peroxide. This process, which was too costly for practical purposes, has been superseded by one discovered by Dr. Caro, who has found that this ketone base can be made to form condensation products with dimethylaniline and other products directly, by the use of phosphorus trichloride—this substance converting it first into a chloride, which then reacts on the dimethylaniline, thus—



And this reaction takes place quantitatively, the body being so pure that it readily crystallises from water in prisms, like potassium permanganate, only with very much more brilliant lustre. These contain water of crystallisation. The condensation can also be effected with phosgene gas. The colouring matter obtained by this means is bluer than that obtained from dimethylaniline by oxidation, which consists chiefly of the pentamethyl compound.<sup>1</sup>

Diethylene can also be made into a ketone with phosgene or carbon oxychloride, and this product condensed with diethylaniline yields hexaethylpararosanine.

Instead of dimethylaniline, dimethyl- $\alpha$ -naphthylamine can be used, and in this case a beautiful blue colouring matter is obtained, and if  $\alpha$ -phenylnaphthylamine, the Victoria blue is produced, and by varying the reaction in this kind of way a great variety of colouring matter can be synthetically prepared.

With ammonias this ketone condenses to form the new yellow colouring matter, auramine, with aniline phenylauramine. With quinoline it produces a green very similar to Victoria or benzaldehyde green. I must not, however, spend any more time over this interesting part of the subject, but may say here again we have pure scientific research, conducted for its own sake, bearing fruit. The discovery of W. Michler, which remained for seven years a matter of theoretical interest, now comes forward as a matter of practical value.

(To be continued.)

### THE DEVONIAN SYSTEM OF RUSSIA

M. P. VENUKOFF has recently given a general sketch of the Devonian rocks of Russia. As is well known, these rocks, so largely developed in Russia, contain such a peculiar fauna that geologists have been puzzled to establish a parallel between them and the different subdivisions of the Devonian system of Western Europe. Two great areas of Devonian strata are known in Russia: that of the north-west and that of the central basin. From Esthonia and Livonia the former extends north-eastwards to Lake Onega and perhaps even to the White Sea, and southwards through Pskor and Vitebsk to Moghiber. In Smolensk only traces of Devonian rocks have been found; but further south-east a great tract of these rocks runs through Tula, Orel, Voronezh, Ryazan, and Tamboff.

Prof. Grewinck, in his "Geologie von Livonia und Kurland" in 1861, and again in 1879, and Prof. Barbot de Marney, in the Russian *Mining Journal* of 1878, attempted to classify the Russian Devonian deposits; not to mention the earlier English work of Murchison, followed by those of Pander, Pacht, Hilmersen, and Kutorga, and recently by those of MM. Stucken-berg, Inostrantseff, and Romanovsky. The mixed characters of the fauna have thus always presented great difficulties in the way of satisfactory correlation.

The recent monograph by M. Tschernyskev (*Mem. Geol. Committee*, i., 3) shows how rich a field remains to be explored before our knowledge of the Devonian fauna of Russia in any measure approaches completion.

M. Venukoff, in his *résumé* of the present condition of the problem, gives a brief account of all that is known as to the Russian Devonian system in each separate government, followed with an analysis of the work done by previous geologists. He then presents a detailed exposition of his own observations and conclusions in North-West and Central Russia; giving long lists of fossils which comprise the rich collections recently made by M. Antonowitsch. In the north-western basin three stratigraphical series have long been known: the lower sandstones, the middle limestones, and dolomites, and the upper sandstones. The lower member contains only fishes and small *Lingule*, though on the Oyat the ichthyolites are accompanied with *Rhynchonella livonica*, *Streptorhynchus crenistria*, *Avicula rostrata*, *Isocardia*, and numerous *Alge*. The fauna of the limestones is mostly that of deeper water, but even among these strata there occur occasionally—as at Lake Ilmen—beds of sandstone with shallow-water forms (the fishes *Coccosteus*, *Asterolepis*, *Osteolepis*, and the little *Lingula bicarinata*, Kut.). On the whole the middle limestones of Pskor and Novgorod may be sub-divided into four stages or zones characterised, the first, by *Rhynchonella Meyendorffii*, *Rh. livonica*, *Spirifer muralis*, *Atrypa reticularis*, *Orthis striatula*, and *Strophalosia product-*

<sup>1</sup>See Patents, Caro, 4428, September, 1883; 4850, March 13, 1884; and 5038, March 18, 1884.

oïdes; the second, by the same fossils, but without *Rh. Meyendorffii*, and with two additional species of *Spirifera* (*S. disjuncta* and *S. lenticula*); the third has yielded only these two *Spirifers*, and *Str. productoides*, while the fourth contains also *Atrypa reticularis* and *Orthis striatula*. Among the Devonian rocks of Central Russia, which consist only of limestones, M. Venukoff tries to establish the following four subdivisions: the Voronezh marls and limestones characterised by the presence of *Spirifera Anosoffi*, together with *Atrypa reticularis*, *Strophalosia productoides*, several *Orthoceratites* and Corals, the Elets beds, where *Sp. disjuncta*, and a variety of *Sp. Archiaci* replace *Sp. Anosoffi*, the other leading fossils being: *Rhynchonella livonica*, *Athyris concentrica*, *Productus subaculeatus*, *P. membranatus*, *Strophalosia productoides*, *Streptorhynchus crenistria (umbraculum)*, *Pleurotomaria*, *Euomphalus*, &c. The intermediate beds between these two groups are especially rich in corals (*Aulopora serpens*, *Cyathophyllum ceratites*, *Syringopora abdita*, *S. tabulata*, species of *Stromatopora*, &c.). The Elets beds are covered with a series of limestones characterised by the presence of *Arca orellana*, and these last are followed by the well-known group of Muravuya (in Ryazan) which constitutes a passage between the Devonian and Carboniferous systems. The correlation of the subdivisions of the deposits of the Devonian groups of North-Western with those of Central Russia, and of both with those of Western Europe, is beset with difficulties. Still it appears that the limestones of Elets and Voronezh, as also those of the Duna (especially since M. Antonowitsch's researches), are comparable with the *Stringocephalus* group of the Eifel and Nassau; some resemblance may also be traced between the Elets and Voronezh limestones and the higher parts of the Middle and Lower members of the Upper Devonian system of England. They may likewise represent the "Frasnien" subdivision of the Upper Devonian series of the Boulonnais. Regarding the Lower Devonian Sandstones of Russia, Murchison's correlation of them with the [Lower] Old Red Sandstone of Caithness and Elgin remains unshaken. The break between these sandstones and the Silurian deposits which they cover seems also to be confirmed. As to the Devonian rocks of Poland, it appears from M. Mikhalsky's researches (*Izvestia of the Geol. Committee*, 1883) that the Lower, Middle, and Upper Devonian divisions of Western Europe are found there, the Upper being akin to the *Rhynchonella cuboides* group of the Eifel. Again, on the other side of the country the discovery on the eastern slope of the Ural of a *Clymenia* closely akin to the *C. annulata* and the *C. spinosa* (*Izvestia*, 1884, 4) is a fresh confirmation of the likeness of the Ural Devonian rocks to those of Western Europe. According to M. Tschernyshev the limestones of the western slope of the Middle Ural chain belong to the Lower Devonian, those of the Byclaya River (*Izvestia*, 1885, 3) belonging to its lower subdivisions.

### SCIENCE IN BOHEMIA

THE Royal Bohemian Society of Sciences celebrated, on December 6 of last year, the hundredth year of its public existence. Occasion has been taken to issue some special publications, comprising a historical sketch of the Society and a *résumé* of the principal researches, a list of all papers, and another of members, since the commencement. The Society originated in a private one for study of science and history started in 1770 under the presidency of Ignaz von Born, who was not only an able scientist of the time, but an ardent freemason (as were many of his fellows). It is a curious fact, throwing light on the aims of this Society, that its publications were all in German, not in Latin, the usual scientific medium in Bohemia at that time. No one thought of using Bohemian for science. Now a considerable portion of papers appear in Bohemian, not always accompanied by a German *résumé*, through which some are rendered more accessible to the average linguist here.

Of the various scientific work recorded in the *Abhandlungen* and *Sitzungsberichte* for 1883-84 we may first notice that on fossil forms. The sponges of the Bohemian chalk formation, as represented in the Prague Museum, are being gone through by M. Pocta. In the new method of studying such remains, special weight is attached to inner structure, the outer form being regarded as of secondary importance; and following this course M. Pocta contributes the first two portions of a careful and finely-illustrated monograph dealing with the *Hexactinellide* and

*Lithistide*, two of the seven orders of Zittel's classification. M. Pocta describes elsewhere the varieties of isolated sponge spicules met with in the chalk. Some sponge remains from the Lower Silurian strata of Bohemia resemble (according to M. Feistmantel) the species *Acanthospongia Siluriensis*, described by MacCoy in 1846, and found at Cong, near Galway. We further notice accounts of fossil flora of the anthracite formation in Central Bohemia (M. Kusta), and of remarkable stem remains of *Araucarioxylon* from the same (M. Feistmantel), &c. M. Novak shows from Bohemian trilobites how the form and markings of the hypostome offer good generic characters which may be taken as decisive where the other parts of the body agree.

Among interesting fossils brought before the Society is a scorpion from the "Moravia" coal-pit at Rakonitz. This is one of the little known order of *Pedopalpi*, and is the first fossil representative of a still living genus, *Thelyphonus*, and probably of the order. Its great similarity to present forms is noteworthy, showing persistence of type in this genus from the Carboniferous period. The same pit has yielded four new spiders, and the number of known Palæozoic arachnida is now (according to M. Kusta) 34. A fossil cockchafer was found in a mass of Tertiary quartz received from France at a millstone manufactory in Prague. The body stood nearly free in an oval hollow of the stone, doubtless corresponding to the cocoon. M. Fric has sent it to the Jardin des Plantes, Paris.

From a chemical examination of the dark colouring matter of ebony, M. Belohoubek concludes that it is to be regarded as coal, and the case is a striking one, as being that of carbonisation of plant material occurring physiologically in a living plant. The author not having sufficient young ebony could not exactly determine the mother-substance. M. Celakovsky finds in certain anamorphoses of the ovulum of *Raphanus sativus*, L., and in abnormal leaves of *Croton*, evidence in support of the foliolar theory of the ovulum. M. Palacky furnishes two instalments of his valuable, though necessarily incomplete and tentative sketch of the geographical distribution of plants. The formation of serial buds is studied by M. Velenovsky. M. Hansgirk extends the knowledge of Bohemian algae (imperfectly studied hitherto), and there are yearly reports on the additions to Bohemian botany.

The organs of excretion of *Hirudinea* are to be regarded (according to M. Vijdovsky) as modified "segmental organs" of the *Oligochaeta*; as the former worms may be considered as *Oligochaeta* degenerate through parasitism. The same author furnishes an account of the freshwater sponges of Bohemia; he finds five well-characterised species with some varieties belonging to the three sub-genera, *Euspongilla*, *Ephydatia*, and *Trichospongilla*. Of freshwater Bryozoa M. Kafka finds in Bohemia thirteen species, two of them new. M. Bayer shows how widely apart *Pelobates* and *Bombinator* are in the structure of their skeleton, and offers a new classification of the Anoura.

Considering the nature of steel-hardening from the electrical standpoint, in connection with the corresponding behaviour of some silver alloys, MM. Strouhal and Barus arrive at the result that neither the mechanical nor the chemical hypothesis as to steel hardening suffices alone to explain the phenomena, and, while the proportion of carbon is the principal factor for determining the behaviour of steel, this behaviour must be explained by a combination of chemical and mechanical influences. The authors offer a definition of steel on the basis of the electrical behaviour of iron with increasing proportion of carbon. M. Kolacek makes a contribution to the theory of the Gramme machine. M. Seydler investigates the application of the principle of energy to the pondero-motive and electro-motive actions of the electric current, also the theory of tension of electrostatic phenomena from the standpoint of the theory of elasticity. There are various papers in mathematics, crystallography, &c., which we must not stop to notice. Tables of rainfall at different stations of Bohemia are furnished by M. Stodnicka.

To this brief account, indicating some directions of recent Bohemian science, we will add a word about the great work of Barrande. That eminent geologist, who died on October 5, 1883, left his collections, &c., to the Bohemian Museum; he also left directions and funds for the completion of his "Système Silurien du Centre de la Bohême," of which twenty-two volumes had appeared between 1852 and 1881. Drs. Waagen and Novak now undertake, at Barrande's request, the further work required. The text and plates relating to the Gastropods and Echinoderms were found in a nearly finished state, but the Polyps, Graptoliths, and Bryozoa have still to be worked out for